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Description

INFLATOR FOR AIR BAG

Technical Field where the Invention Belongs

The present invention relates to an inflator for an air bag whose stability at the time of activation is improved, and, in particular, to an inflator for a side collision in which a developing pattern or the like can be adjusted finely according to a variety of physical builds of passengers (a difference in height, a variety of heights, sitting heights or the like).

Background Art

As an inflator for an air bag mounted to such a vehicle as an automobile, there have been provided various inflators including an inflator for a driver side, an inflator for a passenger side, an inflator for a side collision, an inflator for a curtain air bag, an inflator for a pretensioner and the like according to their mounting positions, their objects and the like.

Among them, the inflator for a side collision is used in an air bag system (an air bag system for a side collision) for improving safety at the time of side collision of a vehicle, and it is mounted to a seat back, a B pillar (center pillar) or the like in many cases. The side air bag system has been conventionally provided as one for mainly reducing damage to the breast of a passenger at the time of side collision. In recent years, however, ones for protecting not only the breast

of a passenger but also the head have been provided as well.

However, since an air bag mounted to an inflator for a side collision which is currently provided is a single bag body which does not have any partition therein, it is difficult to achieve an optimal protection corresponding to a variety of physical builds of passengers (particularly, a variety of heights, sitting heights or the like). That is, in case of protecting the breast or the head of a short passenger, it is necessary to mount an air bag for a side collision at a low position in a seat back, a B pillar or the like. On the other hand, it is necessary to mount an air bag at a high position in order to protect the head or the breast of a tall passenger. In order to accommodate these conditions with one air bag, a considerably large air bag is required. As a result, an inflator with a large size which can discharge a large amount of gas sufficient for allowing inflation of the large air bag is forced to be used. On one hand, however, there is also a limitation regarding an arrangement position of an inflator for a side collision air bag. For this reason, a huge sizing of an inflator volume causes a problem about an installation place or the like.

Therefore, with regard for such specialty of the inflator for a side collision that an air bag is inflated in the vertical wide range to protect the head and breast of the passenger, an inflator for side collision in which a developing condition can be adjusted according to a variety of builds of passengers and that can be made compact is demanded.

However, in an inflator for a side which is currently provided, only one igniter is used for starting activation, as shown in, for example, US-B 5542702 and the like, and an inflation condition of the air bag can not be changed optionally, because a discharge condition of a gas discharged by activation of the igniter is specified unambiguously.

As an inflator where a discharge condition of a gas can be adjusted at the time of activation, there has been proposed one (a dual type inflator) where activations of two igniters are adjusted, as shown in, for example, US-B 6039348 and the like. However, a conventional inflator is to be mounted in the passenger side and is not include the specialty of the inflator for a side collision (such a specialty that an air bag is inflated in the vertical wide range to protect the head and breast of the passenger), and thereby, the conventional inflator cannot be directly applied to the inflator for a side collision. That is, even if this inflator is applied to an inflator for a side collision, since such a constitution is not changed that a gas is ejected into one air bag and a developing pressure of the whole air bag is merely changed, an optimal protection according to the physical build of the passenger can not be achieved. Further, the content of the disclosure in the same publication includes a proper use of either one of the igniters according to the magnitude of an impact, but does not include the art for varying an inflating portion according to a size of the passenger.

Further, in US-B 5794973 (in particular, Fig. 10 in the

document), such an inflator is shown that an internal space is partitioned into two chambers by providing a partition member at the center in a housing and igniters and propellants are disposed at end portions of the respective chambers, and gas discharging ports which are different in opening and a communication hole connecting the both chambers to each other are formed in the partition member. However, also this inflator feeds a gas into a single air bag and changes only a developing pressure, hardly realizing the optimal protection according to a build of a passenger.

Furthermore, when a vehicle (called a "vehicle A") provided with an air bag and another vehicle (vehicle B) collide against each other, a protruded portion (for example, a bumper, a distal end portion of a hood or the like) of the vehicle B deforms the body of the vehicle A. At this time, according to the height of the vehicle A (strictly speaking, a height of a sitting face of a seat from the ground), a problem occurs about which portion of a passenger in the vehicle A the air bag hits at first. For example, when the vehicle B collides to a side of the vehicle A with a short height (a height of a seat from the ground is short), or the side of the body of the vehicle A deforms and a portion of the vehicle A corresponding to the protruded portion of the vehicle B exists at an upper portion of a passenger, so that the portion hits the passenger in the vehicle A at first. Therefore, in the conventional air bag system, there has not been a sufficient consideration about which portion of a passenger should be protected preferentially

according to the height of the vehicle (the height of a seat) .

Patent Document 1 US-B 4,442,702

Patent Document 2 US-B 6,039,348

Patent Document 3 US-B 5,794,973

Disclosure of the Invention

An object of the present invention is to provide an inflator for a side collision in which a developing condition of an air bag can be adjusted according to a variety of builds of passengers or a height (a height of a seat) of a vehicle with regard for such specialty of the inflator for a side collision that an air bag is inflated in the vertical wide range to protect the head and breast of the passenger, and that can be made compact.

The present invention solves the above-described problem by an inflator having two igniters, narrow paths being provided on axial both sides of the inflator and the narrow paths existing on the axial both sides being made different in flow path sectional area for a gas.

That is, the present invention is an inflator for an air bag comprising

a tubular inflator housing which is provided at axial both sides thereof with opening portions,

diffuser portions which are mounted at axial both ends of the inflator housing and are provided with a gas discharging port which discharges pressurized medium flowing out from the opening portions into an air bag,

rupturable plates which closes the respective opening portions of the inflator housing or any of the gas discharging ports to seal the pressurized medium inside, and

igniters which are provided to correspond to the respective rupturable plates and rupture the rupturable plates,

wherein narrow paths for regulating respective flow amounts of the pressurized medium are provided at axial both sides of the inflator housing, and

a gas flow path sectional area (A) of either one of the narrow paths and a gas flow path sectional area (B) of the other narrow path are different from each other.

As the igniter constituting the inflator, a conventionally known electric igniter is used and it receives an ignition signal from an external ignition signal outputting means to be activated. For electric connection between the ignition signal outputting means and each igniter, a bus system can be utilized. Then, the igniters can be provided inside the diffuser portions provided at the axial both sides of the inflator housing. Incidentally, a gas generating agent which is ignited and burnt by a flame generated by activation of the igniter can be provided in the vicinity of the igniter and between the igniter and the rupturable plate.

The rupturable plate closing either of the opening portions of the inflator housing or the gas discharging port is formed by using metal or the like to be ruptured by activation of the igniter. The rupturable plate is ruptured by the igniter, so that a gas is discharged from the opening of the inflator

housing and it is discharged from the gas discharging port. For rupturing the rupturable plate effectively, it is preferable that the igniter is disposed such that its portion which discharges a flame or energy by activation thereof is exactly opposite to and close to the rupturable plate.

As the pressurized medium charged into the housing, a known pressurized medium used in an inflator using a pressurized medium exclusively as a gas source for inflating an air bag, an inflator of a hybrid type or the like, for example, such a pressurized gas as argon or helium, nitrogen gas can be used.

The narrow paths which regulate a flow amount of pressurized medium are provided at the axial both sides of the inflator housing, and a gas flow path sectional area (A) of either one of the narrow paths and a gas flow path sectional area (B) of the other narrow path are made different from each other.

Such a narrow path refers to a portion whose flow path sectional area is narrowed for regulating the gas flow amount when the pressurized medium charged inside the inflator housing is discharged from each gas discharging port, and the flow path sectional area of a gas can be obtained as an area of a face orthogonal to a flow direction of a gas.

As the narrow paths, plural gas discharging ports formed in each diffuser portion can be used. In this case, the total opening area of the gas discharging ports formed on one of the diffuser portions and the total opening area of the gas discharging ports on the other diffuser portion are made

different.

As the narrow paths, the opening portions provided on the axial both ends of the inflator housing can be used. In this case, an opening area of the opening portion formed at one axial end of the inflator housing and an opening area of the opening portion formed at the other axial end of the inflator housing are made different from each other. Besides a case that the opening portion is formed by bending the axial end portion of the inflator housing in an inward flange shape, such a constitution may be employed that a washer-like ring member is provided at the axial end portion of the inflator housing and an inner hole thereof is utilized as the opening portion. Such a ring member may be fitted to a stepped portion provided in the end portion of the inflator housing, or it may be fixed in the diffuser portion provided at the axial end portion of the inflator housing.

Further, as the narrow paths, clearances formed between inner peripheral surfaces of the diffuser portions and outer peripheral surfaces of the igniters can be used. That is, the clearances are formed between the inner peripheral faces of the diffuser portions and the outer peripheral faces of the igniters by holding the igniters which rupture the rupturable plates insides each of the diffuser portions, and portions of the clearances from the opening portions to the gas discharging ports may be defined as the narrow paths. In this case, the minimum diametrical sectional area of the clearance between the inner peripheral surface of one diffuser portion and the outer

peripheral surface of the igniter and the minimum diametrical sectional area of the clearance between the inner peripheral surface of the other diffuser portion and the outer peripheral face of the igniter are made different from each other.

By making the gas flow path sectional areas in the narrow paths different in this manner, the amounts of gases discharged from the respective gas discharging ports are regulated, so that the gas passes through the narrow path having the larger flow path sectional area and the gas is discharged preferentially from the diffuser portion (in fact, the gas discharging port) in which the narrow path having the larger flow path sectional area is formed. Thereby, it is made possible to adjust the discharge amount of a gas from each gas discharging port optionally. By adjusting activation timings of the igniters, the discharge condition of a gas from each gas discharging port can be adjusted optionally. Regarding the gas flow path sectional areas in the narrow paths which are different in the axial direction of the inflator housing, a ratio of a small gas flow path sectional area (A) : a large gas flow path sectional area (B) is in the range of 1 : 1 to 1 : 6 , preferably in the range of 1 : 1.3 to 1 : 5, and further preferably in the range of 1 : 1.5 to 1 : 4. By setting the ratio of (A) : (B) in this manner, the discharge condition of a gas can be adjusted more preferably.

In the inflator of the present invention, since the diffuser portions are provided at the axial end portions of the inflator housing, individual and independent air bags or

individual and independent gas introducing ports provided in one air bag are easily and securely coupled to the respective diffuser portions.

By using the above-described inflator, an air bag system of the present invention described below can easily be formed.

An air bag system according to the present invention is one formed with the above-described inflator and an air bag, thereby solving the above-described problem.

An air bag used in the air bag system of the present invention may be one air bag (bag body) which is formed with different gas introducing ports (namely, a first gas introducing port and a second gas introducing port) connected to the respective diffuser portions, and it may comprise plural air bags, the different air bags being connected to the respective diffuser portions. Accordingly, in the inflator for an air bag according to the present invention, gases discharged from the respective diffuser portions each inflate different air bag portions (the former aspect) or the air bags (the latter aspect).

In particular, when an air bag which has plural gas introducing ports, the respective gas introducing ports being connected to different diffuser portions is used, it is desirable that an inner space of the air bag is partitioned into a space connected to a first gas introducing port and a space connected to a second gas introducing port and these spaces are partially in communication with each other. By partitioning the inner space of the air bag, air bag portions (namely,

partitioned air bag chambers) can be inflated independently for respective gases flowed in from the respective introducing ports. By putting two spaces in communication with each other at a portion, a gas communication inside the air bag is made inside the air bag. As a result, the internal pressure in one air bag portion can be prevented from being raised excessively.

In the inflator used in the air bag system, the narrow paths which each regulate flow amounts of the pressurized medium are provided at axial both sides of the inflator housing and an output or a discharge amount of a gas between the gas discharging ports existing at the axial end portions is adjusted by making both the narrow paths different in gas flow path sectional area, so that an inflator for an air bag where inflating conditions of respective air bags or air bag portions (air bag chambers) can be adjusted according to which diffuser portion is connected to the air bags or the air bag portions can be achieved. That is, considering such a specialty of the inflator for a side collision that inflation is made over a broad range in a height direction in order to protect the head and breast of a passenger, an inflator for a side collision where an inflation condition for an air bag can be adjusted according to a physical build (in particular, a height difference or a sitting height difference) of a passenger and reduction in size can be realized can be obtained. Further, at the time of a side collision where the inflator for a side collision functions, a space allowing absorption of an impact energy is small as compared with a front collision and the air bag must be developed

for a shorter time. However, by adjusting an output and a discharge amount of a gas, a portion of the air bag which must develop more rapidly can be inflated selectively in a preferential manner.

In particular, when one diffuser portion of the two diffuser portions provided at the axial both ends of the inflator housing is coupled to an air bag or an air bag portion (air bag chamber) existing in the vicinity of an upper lateral part of a passenger (namely, in the vicinity of the head) and the other diffuser portion is connected to another air bag or another air bag portion existing in the vicinity of a lower lateral part of the passenger (namely, in the vicinity of the breast), it is preferable that a gas flow path sectional area (A) of the narrow path formed at the side of the diffuser portion connected to the air bag or the air bag portion (air bag chamber) existing in the vicinity of the upper lateral part of the passenger is formed to be smaller than a gas flow path sectional area (B) of the narrow path formed at the side of the diffuser portion connected to the air bag or the air bag portion (air bag chamber) existing in the vicinity of the lower lateral part of the passenger. By increasing the ratio of the supply amount of a gas to the air bag or air bag portion corresponding to the lower portion of the passenger (namely, the air bag or the air bag portion protecting the breast of the passenger in this manner), an air bag system which can restrain both a short passenger and a tall passenger securely regardless of the height of the passenger can be achieved. By inflating the air bag or

the air bag portion (air bag chamber) on the upper lateral part for a tall passenger additionally, the head of the passenger can further be protected securely.

Further, if the inflator for a side collision of the present invention is provided in a vehicle having a low sitting position of a passenger, it is desirable that a gas flow path sectional area (A) of the narrow path formed at the diffuser portion connecting to the air bag or the air bag portion (air bag chamber) around upper lateral part of the passenger is formed to be larger than a gas flow path sectional area (B) of the narrow path formed at the diffuser portion connecting to the air bag or the air bag portion (air bag chamber) existing in the vicinity of the lower lateral part of the passenger.

That is, at the time of a side collision of a vehicle, when a sitting position of a passenger in a collided vehicle is positioned at an average height of general automobiles (for example, the collision portion (collided portion) of the colliding vehicle (the other vehicle) exists in the vicinity of the breast of the passenger. Therefore, as described above, in order to avoid a damage to the breast, it is necessary to first inflate a portion of an air bag or an air bag portion (air bag chamber) existing in the vicinity of the breast of the passenger. However, when the sitting position of the collided vehicle (for example, a sports car of the like) is lower than the average height in the ordinary automobiles (for example, the height of the seat from the ground is about 350 mm), a collided portion of the collided vehicle is eventually positioned in the vicinity

of the head of the passenger in the collided vehicle or in the vicinity of his/her breast.

Therefore, when the inflator for a side collision is installed in such a vehicle having a low sitting position of a passenger (for example, a vehicle in which a height of a seat from the ground is in the range of 250 to 350 mm), it is desirable that the flow path sectional area (A) is formed to be larger than the flow path sectional area (B) and an air bag or an air bag portion (air bag chamber) existing at the collided portion in the vicinity of the head of the passenger or in the vicinity of the breast is inflated preferentially.

Further, in the above inflator, it is desirable that a partition plate developed in the diametrical direction is disposed inside the inflator housing to partition the interior of the housing into a first chamber and a second chamber, and a hole portion having a small gas flow path sectional area is provided in the partition plate. Desirably, the gas flow path sectional area of the hole portion is smaller than that of the narrow path having a smaller gas flow path sectional area between the narrow paths formed at the axial both ends of the inflator housing. By making formation in this manner, when one igniter is activated, all the pressurized medium existing in the housing is prevented from being concentrated on one air bag portion (air bag chamber) or one air bag at a time. After the pressurized medium in either one chamber flows into one air bag portion (air bag chamber) or one air bag, the pressurized medium in the other chamber gradually flows in the bag while its flow

rate is being restricted by the hole portion, so that an impact to a passenger due to development of the air bag is moderated. Furthermore, by charging a gas into either one (a first chamber or a second chamber) of chambers partitioned in the housing, a gas can be charged into the other chamber (the second chamber or the first chamber) with an equal pressure.

Moreover, it is desirable that the interior of the inflator housing is partitioned by a partition plate having a hole portion and developing in the diametrical direction and the hole portion is closed by a closing member from the side including the narrow path having a larger gas flow path sectional area between the narrow paths formed at the axial both sides of the inflator housing. By making formation in this manner, when a gas is discharged from the diffuser portion having the narrow path with a larger gas communication area, the closing member is ruptured due to a pressure difference between the chambers and all the gas in the housing is discharged into the air bag. However, when the gas is discharged from the diffuser portion having the narrow path with a smaller gas communication area the closing member is not ruptured (peeled off) even due to the pressure difference, so that only the gas in one portion of chambers is discharged into the air bag. That is, an inflator for an air bag where development condition of an air bag can be finely adjusted according to a physical build (particularly, a height or a sitting height) of a passenger can be achieved. Further, after the pressurized medium in one chamber (a first chamber or a second chamber) defined in the

housing is discharged, when the pressurized medium in the other chamber (the second chamber or the first chamber) is discharged from the same gas discharging port through the one chamber (the first chamber or the second chamber), the flow rate of the discharged gas can be adjusted by adjusting the opening area of the hole portion (namely, a flow rate adjusting function by the hole portion).

According to the present invention, with regard for the specialty of an inflator for a side collision which vertically inflates over a broad range to protect the head and the breast of a passenger, an inflator for a side collision in which an inflation condition for an air bag can be adjusted according to a physical build of a passenger and reduction in size can further be achieved is provided.

Brief Description of the drawings

Fig. 1 is an axial sectional view of an inflator;

Fig. 2 is an enlarged schematic view of a main portion showing an air bag system;

Fig. 3 is an axial sectional view showing another aspect of an inflator;

Fig. 4 is an axial sectional view showing still another aspect of an inflator;

Fig. 5 is an axial sectional view showing still another aspect of an inflator;

Fig. 6 is an axial sectional view showing still another aspect of an inflator;

Fig. 7 is an axial sectional view showing still another

aspect of an inflator;

Fig. 8 is an axial sectional view showing still another aspect of an inflator;

Fig. 9 is an axial sectional view showing still another aspect of an inflator;

Explanation of Numerals

- 10 inflator for an air bag
- 11 inflator housing
- 12 opening
- 13 rupturable plate
- 14a first diffuser portion
- 14b second diffuser portion
- 15a first igniter
- 15b second igniter
- 16a first gas discharging port
- 16b second gas discharging port
- 17 partition plate
- 18 hole portion
- 19 closing member
- 20 air bag
- 20a first air bag chamber
- 20b second air bag chamber
- 21a first gas introducing port
- 21b second gas introducing port
- 100 flange portion
- 112, 212 opening portion
- 200 ring member

201 stepped portion
202 perforated member
300 clearance
315 igniter

Preferred Embodiments of the Invention

Embodiments of the present invention will be explained with reference to the drawings. Figs. 1, 3 and 4 are axial sectional views showing a first embodiment of an inflator of the present invention, Fig. 2 is an enlarged schematic view of a main portion showing an air bag system using the inflator of the present invention, and Figs. 5 to 8 are axial sectional views showing other embodiments of the inflator of the present invention.

Embodiment 1

An inflator 10 shown in Fig. 1 is constituted by closing opening portions 12 existing at axial both sides of a tubular inflator housing 11 with rupturable plates 13 made of metal material, respectively, and charging a pressurized gas such as argon, helium or nitrogen gas into an inner space of the inflator housing 11.

The opening portions 12 of the inflator housing 11 closed with the rupturable plates 13 are connected with diffuser portions 14 having gas discharging ports, and electric igniters 15 are enclosed and fixed in spaces in the diffuser portions 14.

In this embodiment, the gas discharging ports formed in

the diffuser portions 14 are used as narrow paths. For this reason, the total areas of the gas discharging ports formed in the diffuser portions 14 are different between the diffuser portions 14.

In the following, for the sake of explanation of the embodiment, the gas discharging ports which are formed to have a smaller total opening area are defined as first discharging ports 16a while the gas discharging ports which are formed to have a larger total opening area are defined as second discharging ports 16b. Further, the diffuser portion formed with the first gas discharging ports 16a is defined as a first diffuser portion 14a while the diffuser portion formed with the second gas discharging ports 16b is defined as a second diffuser portion 14b. And an igniter in the diffuser portion 14a is defined as a first igniter 15a while an igniter in the diffuser portion 14b is defined as a second igniter 15b.

Particularly, in this embodiment, the opening diameters of the first gas discharging ports 16a are made small and a total opening area (A) of the first gas discharging ports 16a is made smaller than a total opening area (B) of the second gas discharging ports 16b, as shown in the drawing, but such a constitution can be employed that the total opening area (A) is made smaller than the total opening area (B) by setting the opening diameters of the first gas discharging ports 16a and the second gas discharging ports 16b to be equal to each other and setting the number of the first gas discharging ports 16a to be fewer than the number of the second gas discharging ports,

or by adjusting the opening diameters and the numbers of the respective ports.

In this embodiment, the number of the first gas discharging ports 16a is six, each having an inner diameter of 4 mm (which results in a total opening area of about 75.4 mm^2), and the number of the second gas discharging ports 16b is six, each having an inner diameter of 7 mm (which results in a total opening area of about 231 mm^2).

In the inflator 10 shown in this drawing, since the diffuser portions 14 formed with the gas discharging ports exist at axial both sides of the inflator housing 11, such a constitution can be employed that different air bags 20 are connected to the respective diffuser portions 14 or introducing ports of a gas to the air bag 20 are varied. Since the total opening area (B) of the second gas discharging ports 16b is larger than the total opening area (A) of the first gas discharging ports 16a, the gas is preferentially discharged from the second diffuser portion 14b so that the second diffuser portion 14b can be clearly distinguished from the first diffuser portion 14a regarding the amount of gas discharge. Therefore, by adjusting activation timings of the respective igniters 15, the amounts of gases discharged from the respective diffuser portions 14 can be adjusted finely.

Using the inflator 10 formed in this manner, an air bag system such as shown in Fig. 2 can be formed.

In many cases, the inflator 10 formed in this manner is installed at the time of vehicle mounting as an air bag system

obtained by combining an activation signal-outputting means comprising an impact sensor and a control unit, and a module case accommodating the above-described inflator 10 and an air bag 20 (a bag body) are accommodated. The air bag 20 (a bag body) is connected to the diffuser portion 14 at an outer peripheral surface of the diffuser portion 14.

Particularly, in the air bag system shown in Fig. 2, an air bag having two gas introducing ports 21a and 21b is used as the air bag 20 (a bag body), and respective spaces in an interior of the air bag are in communication with each other through a communication portion 22 but they are partitioned for respective introducing ports. The two gas introducing ports 21 are each connected to the different diffuser portions 14, and, in Fig. 2, the first diffuser portion 14a is connected to the first gas introducing port 21a and the second diffuser portion 14b is connected to the second gas introducing port 21b.

In the air bag system thus constituted, a space receiving a gas discharged from the second diffuser portion 14b (namely, a space connected to the second gas introducing port, which is hereinafter referred to as a "second air bag chamber 20b") inflates preferentially due to a difference in total opening area of the gas discharging ports. Therefore, when the second air bag chamber 20b is provided to exist in the vicinity of the breast (a lower portion) of a passenger, in case of a tall passenger, his/her breast can be restrained and in case of a short passenger, his/her breast to head can be restrained, that is, an air bag system which can restrain a passenger securely

regardless of his/her physical build can be achieved. A space receiving a gas discharged from the first diffuser portion 14a (namely, a space connected to the first gas introducing port, which is hereinafter referred to as a "first air bag chamber 20a") inflates additionally, thereby being capable of protecting a high portion of the passenger (for example, his/her head). By making the activation timings of the first igniter 15a and the second igniter 15b different, inflation timings and inflation conditions of the respective air bag chambers 20a and 20b can be adjusted optionally.

Incidentally, in addition to the above case, regarding the air bag 20 (the bag body), different independent air bags 20 can be provided to correspond to the respective diffuser portions 14. That is, an air bag which does not have a communicating portion (the communication portion 22) or an air bag where the air bag chamber 20a and the air bag chamber 20b are completely separated from each other can be employed as the air bag 20 shown in Fig. 2.

Regarding the inflator 10 for an air bag, it may be formed like the aspects shown in Figs. 3 and 4.

That is, the inflator 10 shown in Fig. 3 is provided with a partition plate 17 developing in the radial direction in the housing 11, so that an inner space of the housing 11 is partitioned into two chambers. The partition plate 17 is formed with a hole portion 18 having an opening diameter smaller than that of the first gas discharging port 16a. For this reason, a first chamber 10a existing in the first diffuser portion 14a

side of the partition plate 17 and a second chamber 10b existing in the second diffuser portion 14b side of the partition plate 17 are in communication with each other at the hole portion 18.

In the inflator 10 provided with the partition plate 17 having such a hole portion 18, even if only one igniter 15 is activated, a gas is never discharged at a time, so that, after a gas in one defined chamber is discharged, a gas in the other chamber is gently discharged through the hole portion 18. For example, when the second igniter 15b is activated, the gas in the second chamber 10b is rapidly introduced into the second air bag chamber 20b, but, while its flow rate is being regulated by the hole portion 18 with the small opening diameter, the gas in the first chamber 10a enters into the second chamber 10b, so that the gas is gently discharged from the second diffuser portion 14b to the second air bag chamber 20b. For this reason, when the second air bag chamber 20b exists at the breast of a passenger, an urgent bag development can be avoided so that a more effective restraint can be achieved.

Further, as shown in Fig. 4, it is desirable that an inner space in the housing 11 is partitioned by a partition plate 17' having a hole portion 18' to define a first chamber 10a and a second chamber 10b in the axial direction of the housing 11 and the hole portion 18' is closed by a closing member 19' from the diffuser portion 14 side having the larger total opening area of the gas discharging ports (that is, the second diffuser portion 14b side). By making formation in this manner, when the second igniter 15b is activated to discharge the gas in the

second chamber 10b, the closing member 19' ruptures (or peels off) due to a pressure difference between the both chambers, so that the gas in the first chamber 10a is also discharged from the second diffuser portion 14b. Therefore, when the second air bag chamber 20b exists at the breast of a passenger, the second air bag chamber 20b is inflated more sufficiently so that the passenger can be restrained further safely. On the other hand, even if the first igniter 15a is activated so that the gas in the first chamber 10a is discharged, since the closing member 19 is fixed by pressing from the second chamber 10b side, this member is not prevented from rupturing due to a differential pressure so that only the gas in the first chamber 11a is introduced into the first air bag chamber 20a. At this time, the hole portion 18' may be formed to have a flow rate adjusting function as described above.

Embodiment 2

An inflator for an air bag of the aspect shown in Fig. 5 is different from the above inflator for an air bag shown in Fig. 1 particularly regarding the narrow paths. Since the other portions of the former are almost the same as those of the above inflator shown in Fig. 1, the same numerals are attached in the drawing and explanation thereof will be omitted. Incidentally, in this embodiment, the first gas discharging ports 16a and the second gas discharging ports 16b may be the same in opening diameter or the same number of the opening portions, and signs (a and b) for distinguishing the first and the second from each other are used only in view of convenience for explanation.

The inflator shown in this Fig. 5 has opening portions 112 formed at both ends of an inflator housing as narrow paths, and an outflow amount (an outflow speed) of a pressurized medium can be adjusted by changing the opening areas of the respective opening portions 112a and 112b. That is, in this embodiment, one end side or both end sides of the housing is formed as an inward flange-like flange portions 100, and a central opening of the flange portion and an end opening of the inflator housing are formed as opening portions 112a and 112b.

In an aspect where the opening areas of the opening portions 112a and 112b are made different, the gas discharging ports 16a and 16b formed at the respective diffuser portions 14a and 14b are formed to have the same opening diameter and the same number of the opening portions (that is, the total opening areas are the same). Incidentally, since the amounts of the gases discharged from the respective diffuser portions 14a and 14b or the like are controlled by the opening portions 112a and 112b formed at the flange portion 100 and the end portion of the inflator housing, the total opening areas of the respective gas discharging ports 16a and 16b formed at the respective diffuser portions 14a and 14b need to be made larger than the opening areas of the opening portions 112a and 112b.

Even in the inflator shown in this aspect, the amounts of the gases discharged from the respective diffuser portions 14a and 14b (in fact, the respective gas discharging ports 16a and 16b) can be finely adjusted optionally by adjusting the activation timings of the respective igniters 15. For this

reason, when the air bag system of the present invention is formed using the inflator, inflation timings and inflation conditions of the respective air bag chambers 20a and 20b can be adjusted optionally.

Further, as shown in this embodiment, when the opening areas of the opening portions 112a and 112b are made different from each other, as shown in Fig. 6 and Fig. 7, washer-like ring members 200a and 200b are each provided at axial both end portions of an inflator housing, and inner holes formed in the respective ring members can also be used as opening portions 212a and 212b.

By making the opening areas of the opening portions 212a and 212b formed in the respective ring members 200a and 200b different from each other like the opening portions 112a and 112b shown in the above Fig. 5, an amount of gases discharged from the respective diffuser portions 14a and 14b (in fact, the respective gas discharging ports 16a and 16b) can be adjusted optionally.

Regarding arrangement of the ring members 200a and 200b, as shown in Fig. 6, such a process can be employed that stepped portions 201 are formed at axial both end portions of a housing formed in a tubular shape and the respective ring members 200a and 200b are fitted into the step portions 201. In this case, rupturable plates 13 are arranged outside the respective ring members 200a and 200b, and the diffuser portions 14a and 14b can be arranged outside thereof. That is, in this aspect, the respective ring members and rupturable plates can be

consequently sandwiched between the inflator housing and the respective diffuser portions 14a and 14b.

Furthermore, as shown in Fig. 7, the ring members 200a and 200b can be fixed inside the respective diffuser portions 14a and 14b provided at the axial both end portions of the inflator housing. That is, the respective diffuser portions 14a and 14b in the inflator housing side are formed in inward flange-like shape, and the respective ring members 200a and 200b provided inside the diffuser portions abut on them and cylindrical porous members 202a and 202b are respectively arranged in the inner spaces of the respective diffuser portions 14a and 14b so that the respective porous members 202a and 202b can be fixed by pressing down them together with the igniters. Openings formed on the peripheral faces of the porous members 202a and 202b are in communication with the respective gas discharging ports 16a and 16b.

Embodiment 3

An inflator for an air bag of an aspect shown in Fig. 8 is different from the inflator for an air bag shown in the above-described embodiment particularly regarding the narrow paths. Since the other portions of the former are almost the same as those of the above-described inflator, the same numerals are attached on the drawing and explanation thereof will be omitted. Incidentally, in this embodiment, the first gas discharging ports 16a and the second gas discharging ports 16b may be the same in opening diameter or the same number of the opening portions, and signs (a and b) for distinguishing the

first and the second from each other are used only in view of convenience for explanation.

The inflator shown in Fig. 8 holds igniters 315a and 315b in inner spaces of respective diffuser portions 14a and 14b, and clearances 300a and 300b occurring between peripheral faces of the respective igniters 315a and 315b and inner peripheral faces of the respective diffuser portions 14a and 14b are defined as narrow paths. In this case, the narrow path is for adjusting flow condition of gas, it needs to exist in a course from the inflator housing (more specifically, an opening portion) to the gas discharging ports. Therefore, in this aspect, the clearances 300a and 300b serving as the narrow paths are portions extending from the opening portions provided in the inflator housing to the gas discharging ports. By making the minimum diametric sectional areas of the clearances 300a and 300b (the areas of portions with the minimum diametric sectional areas of portions provided for gas communication in the inner spaces of the diffuser portions) different, the outflow amount of the pressurized medium (the outflow speed) can be adjusted.

In order to make the minimum diametrical sectional areas of the clearances 300a and 300b different, as shown in Fig. 8, besides a case that the outer diameters of the respective igniters 315a and 315b are made different and the diameters of the inner spaces of the respective diffuser portions 14a and 14b are made equal, such a constitution can be employed that, on the contrary, the outer diameters of the respective igniters

315a and 315b are made equal and the diameters of the inner spaces of the respective diffuser portions 14a and 14b are made different, or both of the outer diameters of the respective igniters 315a and 315b and the diameters of the inner spaces of the respective diffuser portions 14a and 14b are made different.

Even in the inflator shown in this aspect, the amounts of the gases discharged from the respective diffuser portions 14a and 14b (in fact, respective gas discharging ports 16a and 16b) can be finely adjusted optionally by adjusting the activation timings of the respective igniters 315a and 315b. For this reason, when the air bag system of the present invention is formed using the inflator, inflation timings and inflation conditions of the respective air bag chambers 20a and 20b can be adjusted optionally.

Further, Fig. 9 shows an aspect where a gas generating agent 400 which is ignited and burnt due to flame by activation of the igniter 15a to generate a gas is charged inside the diffuser portion. In Fig. 9, the gas generating agent 400 is charged into a cylindrical member 401 surrounding a head portion (a portion in which a priming is accommodated) of the first igniter 15a, and the cylindrical member 401 is provided in the rupturable plate 13 side with an opening 403 closed by a sealing tape 402. Incidentally, a similar cylindrical member is disposed in the second igniter 15b side, namely between the second igniter 15b and the rupturable plate 13, and such a gas generating agent 400 can also be charged into the cylindrical

member.

In an inflator constituted to include the gas generating agent 400 in this manner, when the first igniter 15a is activated, the gas generating agent 400 is burnt by its flame to generate a gas, and the gas can rupture the rupturable plate 13 more securely in cooperation with an activation energy of the igniter 15a.

Incidentally, in the inflator shown in this aspect, it is desirable to provide the partition plate 17 having the hole portion 18 with a predetermined size as shown in the above Fig. 3 or provide the partition plate 17' closed by the closing member 19' from the defined direction as shown in Fig. 4 such that the rupturable plate 13 existing at one end (on the drawing, the second igniter 15b side) is not ruptured by a gas generated by combustion of the gas generating agent 400 existing on the other end (on the drawing, the first igniter 15a side). Then, it is desirable that the hole portions 18 and 18' provided in these partition plates 17 and 17' are deviated from the centers of the respective partition plates.

Incidentally, in this embodiment, the structure where the rupturable plates 13 are mounted to both the opening portions of the housing 11 is shown, but, if rupturable plates are ruptured securely due to activation of igniters so that a desired effect can be achieved, they may be mounted from insides the gas discharging ports 14a and 14b in the diffusers 14.